U.S. ARMY
CAA-R-03-05

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INDUSTRIAL BASE MODEL DATA REQUIREMENTS
(IBMDR)

APRIL 2003

CENTER FOR ARMY ANALYSIS
6001 GOETHALS ROAD
FORT BELVOIR, VA 22060-5230

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CENTER FOR ARMY ANALYSIS

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> Center for Army Analysis
> ATTN: CSCA- RA
> 6001 Goethals Road
> Fort Belvoir, VA 22060-5230

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13. ABSTRACT *(Maximum 200 Words)*

The project determined if a data base existed that could be used in analysis of the organic Department of Defense (DOD) industrial base. This data base, although suitable for numerous analyses, did not contain all the data elements required for the, "Optimizing the Capacity and Operation of U. S. Army Ammunition Production Facilities" model, developed by Vedat Bayram at the Naval Postgraduate School. A new model would have to be developed or the current model changed to conduct an optimization study using the DOD data base presently available.

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INDUSTRIAL BASE MODEL DATA REQUIREMENTS (IBMDR)

SUMMARY

THE PROJECT PURPOSE is to determine the status of the data bases that are required for analyses of the industrial base

THE PROJECT SPONSOR was *the Deputy Assistant Secretary of the Army for Infrastructure Analysis, ATTN: COL Weaver, RM 3D453, 110 ARMY PENTAGON, WASHINGTON DC 20310-0110*

THE PROJECT OBJECTIVES were to:

   (1) Determine if the data is available for an analysis of the industrial base to include populating an existing model developed by NPS.

   (2) Determine the quality of available data.

THE SCOPE OF THE PROJECT is limited to the DOD organic industrial base production of ammunition.

THE MAIN ASSUMPTION is the productivity of the organic industrial base can be modeled using optimization methods.

THE PRINCIPAL FINDINGS are:

   (1) A list of data elements was obtained from the "Optimizing the Capacity and Operation of U.S. Army Ammunition Production Facilities" model developed by Vedat Bayram.

   (2) The Joint Munitions Command (JMC) has a website that provides points of contact for industrial base information.

   (3) There is a database, Preparedness Program Industrial Base Plan (PBP) with sufficient production information to conduct stationing analyses. However, cost information needed for the NPS model is not available in the database. A data list is provided.

   (4) The current database is dated, but the new database might provide some cost data. The usefulness of this data is unknown at this time.

THE PRINCIPAL RECOMMENDATIONS are:

   (1) Investigate the possibility of obtaining the PBP data base in a user friendly format for modeling purposes.

(2) Explore application of PBP data in stationing analyses for the industrial base.

(3) The Center for Army Analysis (CAA) needs to become involved in the creation of the new PBP system.

THE PROJECT EFFORT was conducted by Dr Charles R. Leake

COMMENTS AND QUESTIONS may be sent to the Director, Center for Army Analysis, ATTN: CSCA-RA, 6001 Goethals Road, Suite 102, Fort Belvoir, VA 22060-5230

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1 INTRODUCTION

1.1 Industrial Base Model Data Representation

This study is about industrial data bases and their present status. It is sponsored by the DEPUTY ASSISTANT SECRETARY OF THE ARMY FOR INFRASTRUCTURE ANALYSIS.

1.2 Background

The study is a follow-up to a thesis entitled "Optimizing the Capacity and Operations of the U.S. Army Ammunition Production Facilities" written at the Naval Postgraduate School (NPS). The thesis was written by Vedat Bayram. This study is to determine the data requirements to implement this thesis and their availability.

1.3 Purpose and Objectives

(1) Purpose. We were asked to determine the availability of data for the "Optimizing the Capacity and Operations for the U.S. Army Ammunition Facilities" developed by Vedat Bayram at the Naval Postgraduate School (NPS).

(2) The objectives of the study were:

(a) Determine if the data is available for an analysis of the industrial base to include populating an existing model developed by NPS.

(b) Determine the quality of available data.

1.4 Scope

The scope of this study is limited to the DoD organic industrial base production of ammunition.

1.5 Assumptions

The productivity of the organic industrial base can be modeled using optimization.

1.6 Limitations

There are no limitations to this study.

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1.7 Results

The POCs were contacted and a data file was provided which contains usable numerical data. This data file is: the JMC Industrial Preparedness Program Industrial Base Plan (PBP). The list of data from this file is to be found in Appendix F.

1.8 Principal Findings

The principal findings were:

(1) A list of data elements was obtained from the "Optimizing the Capacity and Operation of U.S. Army Ammunition Production Facilities" model developed by Vedat Bayram This list is to be found in Appendix D.

(2) The Joint Munitions Command (JMC) has a website that provides points of contact for industrial base information.

(3) There is a database, Preparedness Program Industrial Base Plan (PBP) with sufficient production information to conduct stationing analyses. However, cost information needed for the NPS model is not available in the database. A data list is provided for the PBD in Appendix F.

(4) The current database is dated, but a new database being considered might provide some cost data. The usefulness of this new database is unknown at this time.

1.9 Possibilities for CAA to consider

For the present, investigate the possibility of obtaining the PBP in a more user friendly format. Although some portions of it might be dated, it still contains a great deal of useful information that could form the basis for a study of the DOD industrial base. With this in mind, CAA might consider developing an optimization model using the PBP. CAA also needs to become involved in the creation of the new PBP system. Additionally CAA should consider attending production and demilitarization meetings to keep up with the latest production and demilitarization efforts of AMC.

APPENDIX A PROJECT CONTRIBUTORS

1. PROJECT TEAM

a. Project Director:

Dr. Charles R. Leake

b. Team Members:

c. Other Contributors:

LTC William Tarantino

2. PRODUCT REVIEWERS

Dr. Ralph E. Johnson, Quality Assurance

3. EXTERNAL CONTRIBUTORS

David Fair Program Executive Officer, Ammunition

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APPENDIX B   REQUEST FOR ANALYTICAL SUPPORT

P *Performing Division:*   RA   *Account Number:*   **2003105**

A *Tasking:*   *Mode (Contract-Yes/No):*   In-house

R *Acronym:* **IBMDR**

T

Title: Industrial Base Model Data Requirements

1 *Start Date:* 03-Feb-03   *Estimated Completion Date:*   30-Apr-03

Requestor/Sponsor (i.e., DCSOPS):   DASA(IA)   *Sponsor Division:*

Resource Estimates: *a. Estimated PSM:*   3   *b. Estimated Funds:* $0.00

c. Models to be Used: **None**

Description/Abstract: To determine what data is needed to represent the industrial base in a linear programming mathematical model as well as its quality and availability.

Study Director/POC Signature: *Phone#:*   703-806-5136

Study Director/POC: **Dr. Charles Leake**

PART 2

P *Background:* This is the follow-up to a thesis written by Vedat Bayram at Naval Postgraduate School entitled "Optimizing the Capacity and Operation of U.S. Army Ammunition Production Facilities". This study is to determine the data requirements to implement this model and their availability.

A

R

T

Scope: The study is to be done in-house by CAA analysts

2

Issues: The issues for this analysis are: 1. Can a list of data requirements for the above model be developed? 2. Can data be obtained for the variables identified in the list? 3. What is the quality of the data? 4. How long will it take to assemble the data? 4. What resources will be required to obtain the data?

Milestones: The study is to take approximately 3 months to complete. ARB at month 1. Final product will be a listing of data at month 3.

Signatures *Division Chief Signature:* **Original Signed and Dated**   *Date:*

Division Chief Concurrence: **Original Signed and Dated**

Sponsor Signature: **Original Signed and Dated**   *Date:*

Sponsor Concurrence (COL/DA Div Chief/GO/SES): **Original Signed and Dated**

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APPENDIX C BIBLIOGRAPHY

Vedat Bayram, Optimizing the Capacity and Operation of U.S. Army Ammunition Production Facilities, Naval Postgraduate School, Monterey, CA, June 2002

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APPENDIX D   DATA LIST FOR MODEL

Description of data for model (Vedat Bayram, "Optimizing the capacity and operation of U.S. Army munitions production facilities, Naval Postgraduate School Monterey, CA, 2002, pp. 26 - 29)

1. Indices

<u>List of Installations</u> $i \in I$

<u>List of Structures on Installations</u> $s, s' \in S$

a. s is shelter

b. s' is shelter complex

<u>Host installation for structure $s \in S$</u>

i(s)

<u>Process Center $p \in P$</u>

(Hardware e.g. (small metal fab, LAP, energetics, ...))

<u>Subset of structures $s \in S$ that can house process center p</u>

s_p

<u>Process type {eg. small metal fab, LAP, energetics, ...} This set is T</u>

$t \in T$

<u>Process type of process center $p \in P$</u>

t(p)

<u>Calendar year = 0, 1, ..., Y~10</u>

$y^+ \in Y^+$

<u>Years from decision to execution</u>

lag

<u>Frozen years {0, 1, ..., *lag*}</u>

$y^{\#} \in Y^{\#}$

Planning years = $\{lag + 1, lag + 2, ... Y\}$ $Y = Y^{+} - Y^{\#}$
$y, y' \in Y$

Mode of operation $\{$ACTIVEGOGO, ACTIVEGOCO, ACTIVECOCO, ACTIVEFGC, INACTIVEGOGO, INACTIVEGOCO, INACTIVECOCO, INACTIVEFGC, disposed$\}$

$m^{+} \in M^{+}$

Modes if operation when entity is "kept", $M = M' \backslash \{disposed\}$

$m, m' \in M$

"Open-and-working" modes of operation
$\{$ACTIVEGOGO, ACTIVEGOCO, ACTIVECOCO, ACTIVEFGC$\}$

$m^{*} \in M^{*}$

"Closed" modes of operation
$\{$INACTIVEGOGO, INACVTIEGOCO, INACTIVECOCO, INACTIVEFGC$|$

$m^{\#} \in M^{\#}$

Set of admissible transitions from open $m \in M$, to $m^{+} \in M^{+}$

$\{m, m^{+}\} \in MM$

Set of admissible transitions from open $m^{*} \in M^{*}$ to $m^{+} \in M^{+}$

$\{m^{*}, m^{+}\} \in MSM$

Set of admissible transisitions from closed $m^{\#} \in M^{\#}$ to $m^{+} \in M^{+}$

$\{m^{\#}, m^{+}\} \in MCM$

2. Data required

Replenishment capacity required in year y for process type t (tons)
$replencap_{t,y}$

Demand in year y for training rounds from process type t(tons)

$work2train_{t,y}$

Tons produced per shift by process center p in (tons/shift)
shiftyield $_{py}$

Maximum work capacity of process center p in year y working in mode m* (shifts)
workmax $_{p,y,m*}$

Minimum work capacity of process center p in year y working in mode m* (shifts)
workmin $_{p,y,m*}$

Space capacity of structure s (space)
sructspace $_s$

Space requirement of process center p (space)
procspace $_p$

Fixed cost(s) to keep installation i during year y in mode m, and transition to mode m^+ the next year, incurred in y'($)
icost $_{i,y,m+,y'}$

Fixed cost(s) to keep structure s during year y in mode m, and transition to mode m^+ the next year, incurred in y' ($)
scost $_{s,y,m+,y'}$

Fixed cost(s) to keep process center p during year y in mode m, and transition to mode m^+ the next year, incurred in y' ($)

pcost $_{p,y,m+,y'}$

Fixed cost(s) to move process center p during year y from structure s in installation i(s) to structure s' in installation i(s'), incurred in y'($)
mcost $_{p,y,s,s',y'}$

Variable cost of working process center p during year y in mode m* ($/shift)
mcost $_{p,y,m*}$

3. Decision Variables

in year y, keep installation i in mode m and transition to mode m^+ the next year (binary)

OPERATE $_{i,y+,m,m+'}$

In year y, keep structure s in mode m, and transition to mode m+ the next year (binary)
HOUSE $_{s,y+,m,m+'}$

Process center p housed in structure s in year y, and both are open-and-working (binary)
KEEP $_{p,y+,m,m+}$

Process center p housed in structure s in year y, and both are open-and-working (binary)
RUN $_{p,y,s}$

In year y, move process center p from structure s to s' (binary)
MOVE $_{p,y+,s,s'}$

Operation of process center p in open-and-working mode m* during year y (shifts)
WORK $_{p,y,m*}$

APPENDIX E   LIST OF DOD PERSONNEL SURVEYED IN DATA SEARCH

The following is a listing of the individuals which I have contacted in my survey. The list may not be in chronological order. I requested the availability and quality of data that related to the productivity of items. I contacted a number of facilities and organizations in the course of my survey. I informed the individuals my survey was at the request of DA. Some individuals wanted to know specifics about the use of a model. My information which I passed on to them was that there was a model developed at NPS which was being considered, but at this time no model was selected. The contacting of the AAPs was suggested by Mr. Motsek as they would be · a good source for possible data.

Radford AAP

LTC Bryan Butler
Betty Roop
Richard Chapman
Robert Davie

DCMA

Robert Lauk
Charlie Heyel

Rock Island

Alan Buester
Debbie Fordham

AMC-PICA

Kevin Fahi
Matthew Zimmerman

AMC-G3

Jim Sullivan
Mr. Barnett
Gene Zeigler

Hawthorne AAP

Tiny Cardenas

Blue Grass AAP
Tina Di Guglielmo

Joel Hallenberger

Lone Star AAP

Mr. Halton
LTC Barone
Madison Bagley

Milan AAP

Britt Locke

Iowa AAP

LTC Lowman
Mike Hunter

Mc Alester AAP

Paul McDaniel
Mike Hughes

Crane AAP

Listed telephone was out of service

Lake City AAP

LTC James Jones

Louisiana AAP

Jim Hawley

Kansas AAP

Don Dailey

Lone Star AAP

Ken Elliot
Don Schanley
Rich Sai

AMC
COL Walker

Gary Motsek
LTC prendergast
Stan Kahn

Scranton AAP

Emil Kovalchik

Holston AAP

Sue Thacker
Martha Durham
Jerry Hammonds
Mike Mills

Mississippi AAP

Ken Spiers
Wayne Pouguet
John Cecconi

Riverbank AAP

Del Clemens
Robert Mente

Production Staff AMMO

MAJ Grossenheider
LTC Tom Prendergast
Stan Kahn
Robert Lauck
Ray Goldstein

I was also called by Dave Fair, PEO Ammunition, at the request of Matt Zimmerman.

Miscellaneous

Jenkins RQ
Wessel DEMIL
Hornsby DEMIL
Gary Radicic DEMIL

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APPENDIX F   PBP DATABASE LIST OF FILES

Production Base Plan List of Data Elements

List of planned producers (Arsenals and contractors)
Location of each producers
List of planned end items
Yearly production of each end item planned from FY 02 to FY 07
Planned schedule for each end item
Monthly schedule for each end item produced only
Monthly schedule for each end item produced concurrently
Producer for each end item
Production line for each end item
List of planned components
Yearly production of each planned component from FY 02 to FY 07
List of components for each end item with production factor needed per end item
Planned schedule for each planned component
Monthly schedule for each planned component produced only
Monthly schedule for each planned component produced concurrently
Producer for each planned component
Production line for each planned component
*Remarks which indicate percent of production line available when either component or end item is being produced concurrently.
*The monthly schedule appears to include start-up time and learning curve.

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